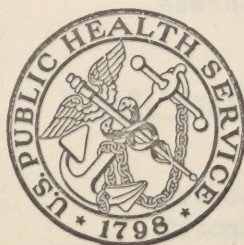


MALARIA CONTROL IN WAR AREAS

MONTHLY REPORT

SEPTEMBER, 1942



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Atlanta, Georgia

FEDERAL SECURITY AGENCY
U. S. PUBLIC HEALTH SERVICE
ATLANTA, GEORGIA

The program Malaria Control in War Areas, a joint undertaking by the United States Public Health Service and the several State Health Departments, is designed to control production of malaria mosquitoes and reduce potential malaria transmission in extra-cantonment zones of military and essential war industrial areas. Operation of the projects is by the State Health Departments utilizing resources of the Public Health Service. Policy direction is exercised by the Atlanta office of the Public Health Service in collaboration with the Public Health Service Districts involved.

STAFF OF MALARIA CONTROL IN WAR AREAS

OFFICER IN CHARGE	MEDICAL DIRECTOR LOUIS L. WILLIAMS, JR.
EXECUTIVE OFFICER	Sanitary Engineer (R) Mark D. Hollis
OPERATIONS OFFICER	P. A. Sanitary Engineer (R) Harry G. Hanson
OFFICE ADMINISTRATION	Sr. Administrative Assistant Max M. English

Professional Services-Headquarters

Field Supervision	Sanitary Engineer (R) Nelson H. Rector
Entomological	Sr. Entomologist George H. Bradley*
Medical	Asst. Surgeon Trawick H. Stubbs
<i>Aedes aegypti</i>	Asst. Sanitary Engineer (R) Wesley E. Gilbert
Personnel	Asst. Sanitary Engineer (R) Chris A. Hansen
Supplies-Equipment	Asst. Sanitary Engineer (R) Ralph C. Palange
Reports-Maps	P. A. Sanitary Engineer (R) Richard L. Wood

P.H.S. District Malaria Control Engineers

District 2	Sanitary Engineer (R) Claud F. Browning
District 3	Asst. Sanitary Engineer (R) J. Frank Field
District 4	P. A. Sanitary Engineer (R) Howard L. Grant
District 6	Sanitary Engineer (R) John M. Henderson
District 7	P. A. Sanitary Engineer (R) Porter A. Stephens
District 9	Assoc. Engineer Sanitarian Don W. Porter

P.H.S. Regional Entomologist

Districts 3 & 7	Assoc. Entomologist John A. Rowe
Districts 4 & 9	Entomologist Travis E. McNeel

*Loaned by U.S. Department of Agriculture, Bureau of Entomology and Plant Quarantine.

SYLLABUS

Effective larvicidal control was maintained throughout September around 95 percent of the 570 war establishments in 137 operating areas. About 350 additional workers were employed in order to assure adequate control although the number of operating areas increased by only three. No evidence of an increase in malaria incidence was reported.

Attempts to recruit professional employees met with more success during September than in previous months. The prospects of getting automotive vehicles and certain heavy equipment for the winter major drainage program are brighter. Training is continuing of non-technical men who are not subject to military service for replacement of professional employees as field supervisors where necessary.

Plans for major drainage work are being made and the policies to govern such work have been formulated and outlined to the states. The temporary nature of the MCWA program requires that less emphasis than usual be placed on permanent control by drainage.

The *Aedes aegypti* control program was expanded to include five small communities in the lower Rio Grande Valley in Texas. Studies are being made to determine the best larvicide for treating "holdover" breeding places in those areas where winter temperatures will stop outdoor breeding.

Collection and examination of slides for the fall thick film survey started during September. The results of the first 3718 slides examined showed 32 positives, or 0.86 percent.

The dog fly control projects along the western Florida Gulf Coast prevented the usual outbreak of these pests and permitted the military activities in the area to proceed in a normal manner. The unusually heavy deposits of marine grasses together with shortages of personnel, equipment and supplies made necessary a reduction in the area covered by the project in order to concentrate on control in the breeding areas closest to concentrations of military personnel.

Preliminary surveys of the cost of controlling pest mosquito production in the vicinity of eleven naval establishments were made at the request of the Navy Department. These indicated that a reasonable reduction in mosquito prevalence could be achieved in seven of these areas at a capital cost of about \$1,000,000 and an annual operating cost of \$400,000. In the other four areas costs would be exorbitant and the control work of questionable effectiveness.

About \$400,000 of Public Health Service funds were encumbered during September of which 84 percent was for personal services.

STATE	Areas in Operation	War Establishments Protected	LARVICIDAL WORK				OTHER WORK			Total Man Hours
			Larvicide Used		Surfaces Treated		Ditching & Cleaning Lin.Ft.	Clearing		
			Oil Gals.	Paris Green Lbs.	Ditches Lin.Ft.	Ponds Sq.Ft.		Ditches Lin.Ft.	Ponds Sq.Ft.	
Alabama	5	35	1,549	---	23,850	2,753,780	13,796	22,470	393,310	7,300
Arkansas	12	27	9,559	1,738	2,768,631	79,056,015	109,853	87,985	2,752,773	27,516
California	2	6	1,524	---	---	1,780,740	75	1,460	76,920	1,134
D. C.	1	8	770	---	76,524	256,000	4,478	13,708	2,834	3,828
Florida	10	58	7,718	7,196	122,245	73,206,783	229,957	55,820	537,979	31,178
Georgia	12	68	54	16,010	415,558	41,426,743	38,595	115,340	2,691,093	19,408
Illinois	3	7	2,176	304	674,440	9,525,753	1,200	6,790	786,003	4,566
Indiana	2	9	1,967	1,411	69,000	3,340,700	---	3,800	115,000	3,072
Kentucky	4	21	7,989	1	687,980	22,305,895	785	11,650	407,300	9,570
Louisiana	8	42	138,249	---	12,754,464	226,700,922	45,820	91,665	78,087	72,257
Mississippi	6	16	10,261	1	1,746,038	1,362,020	83,316	60,298	2,241,193	15,775
Missouri	5	14	4,170	108	40,740	14,896,072	265	85,640	335,500	6,654
North Carolina	9	50	26,769	---	5,670,404	26,812,712	403,217	1,063,721	2,428,815	32,874
Oklahoma	4	10	4,535	37	200,505	14,372,987	15,129	22,670	255,646	7,498
Puerto Rico	6	17	435	5,853	2,505,460	150,333,515	194,077	104,936	544,796	47,684
South Carolina	19	43	49,966	---	5,477,980	109,055,753	348,796	679,744	22,624,428	88,453
Tennessee	9	38	12,352	24	1,782,299	10,887,219	30,522	20,581	313,810	12,765
Texas	14	153	50,041	---	7,777,059	69,080,127	272,252	118,226	5,240,982	53,603
Virginia	4	21	14,670	41,752	1,622,530	18,033,890	44,001	1,795,362	76,230	22,479
Total	136	650	344,754	74,408	44,415,707	875,187,626	1,836,134	4,361,866	41,932,699	467,914

JULY 1 -- SEPTEMBER 30, 1942										
Alabama	---	---	10,814	---	129,350	15,347,750	76,843	47,777	796,550	26,990
Arkansas	---	---	21,783	4,171	8,016,806	180,248,959	387,075	191,873	7,633,498	75,066
California	---	---	1,524	---	---	1,780,740	75	1,460	76,920	1,134
D. C.	---	---	1,320	---	85,894	284,066	9,438	25,095	19,391	7,455
Florida	---	---	36,650	19,061	2,908,987	269,215,729	694,680	191,979	1,834,166	90,641
Georgia	---	---	100	---	929,536	215,644,227	110,415	480,156	9,028,848	52,216
Illinois	---	---	5,513	304	1,132,645	12,370,003	1,200	6,790	2,051,970	9,511
Indiana	---	---	2,712	2,261	69,000	3,576,495	890	25,350	698,750	7,359
Kentucky	---	---	20,721	3	1,583,925	73,416,746	5,387	131,050	2,113,550	29,054
Louisiana	---	---	353,678	5,747	43,935,676	766,000,511	56,310	157,683	555,572	201,919
Mississippi	---	---	40,524	7	6,620,665	9,254,549	284,303	797,850	7,505,283	72,544
Missouri	---	---	6,296	337	103,965	31,813,687	415	93,440	950,172	14,435
North Carolina	---	---	70,804	---	15,688,111	65,414,280	775,393	2,422,478	7,083,497	95,247
Oklahoma	---	---	12,668	37	705,189	24,248,978	60,685	220,793	981,765	22,247
Puerto Rico	---	---	1,501	14,123	6,342,698	383,876,356	372,508	220,014	1,581,800	121,121
South Carolina	---	---	154,707	2,074	17,503,926	356,686,813	1,534,343	2,048,042	61,441,863	270,126
Tennessee	---	---	41,978	53	5,393,304	54,455,701	107,484	97,522	656,452	44,280
Texas	---	---	120,476	2,000	16,644,166	199,558,130	934,332	530,748	25,956,189	155,653
Virginia	---	---	42,438	62,645	4,307,418	53,812,345	149,658	4,028,997	2,757,960	63,621
Total	---	---	946,207	150,068	132,098,261	2,715,006,065	5,561,434	11,715,897	133,724,176	1,359,519

TABLE II

MALARIA CONTROL IN WAR AREAS

NUMBER OF PERSONNEL ON DUTY ON SEPTEMBER 30, 1942 AND TOTAL PAYROLL FOR MONTH OF SEPTEMBER

STATE	TYPE OF PERSONNEL										Total		Percent of Total	
	Commissioned		Prof. & Sci.		Sub-Prof(1)		C. A. F.		Custodial					
	No.	Pay	No.	Pay	No.	Pay	No.	Pay	No.	Pay	No.	Pay	No.	Pay
Alabama	--	---	8	1,783	2	210	1	120	106	10,820	117	12,933	3.1	3.7
Arkansas	--	---	8	1,483	16	2,416	4	492	166	15,678	194	20,069	5.2	5.8
California	--	---	2	*	4	*	1	*	3	*	10	*	0.3	---
D. C.	--	---	---	---	4	623	1	120	15	1,375	20	2,118	0.5	0.6
Florida	--	---	9	1,858	14	1,937	5	583	194	17,077	222	21,455	5.9	6.2
Georgia	--	---	9	1,316	33	4,899	4	517	76	7,029	122	13,761	3.3	4.0
Illinois	--	---	3	600	8	1,170	3	457	19	2,113	33	4,340	0.9	1.3
Indiana	--	---	2	566	4	287	1	120	15	1,574	22	2,547	0.6	0.7
Kentucky	--	---	6	1,239	10	949	1	457	51	5,086	71	7,731	1.9	2.2
Louisiana	--	---	7	1,425	23	3,509	7	721	406	40,183	443	45,858	11.8	13.3
Maryland	--	---	1	267	1	217	2	336	23	2,294	27	3,114	0.7	0.9
Mississippi	--	---	6	1,250	14	2,283	1	120	82	7,937	103	11,590	2.8	3.4
Missouri	--	---	6	1,101	5	425	2	337	35	2,844	48	4,707	1.3	1.4
North Carolina	--	---	7	1,617	17	2,133	5	590	299	29,270	328	33,610	8.8	9.7
Oklahoma	--	---	2	483	4	526	1	120	41	4,190	48	5,319	1.3	1.5
Puerto Rico	1	*	4	*	11	*	6	*	389	*	411	*	11.0	---
South Carolina	--	---	11	2,116	38	4,474	4	517	557	49,606	610	56,733	16.3	16.4
Tennessee	--	---	7	1,466	7	1,142	2	337	59	6,310	75	9,255	2.0	2.7
Texas	--	---	14	2,575	61	6,393	4	534	345	31,500	424	41,002	11.3	11.9
Virginia	--	---	4	966	14	1,968	2	337	146	13,316	166	16,587	4.4	4.8
<u>Aedes Aegypti</u>	--	---	2	433	42	4,885	3	263	50	2,788	97	8,369	2.6	2.4
Florida	--	---	1	83	14	954	1	60	---	---	16	1,097	0.4	0.3
South Carolina	--	---	4	955	3	500	---	---	17	1,587	24	3,042	0.6	0.9
Texas	--	---	---	---	---	---	---	---	---	---	---	---	---	---
H. Q. & Dist.(2)	24	7,500	12	2,328	20	3,234	52	6,592	6	556	114	20,210	3.0	5.9
Total	25	7,500	135	25,910	369	45,134	116	13,730	3100	253,133	3745	345,407	100.0	100.0
Percent of Total	0.6	2.2	3.6	7.5	9.9	13.1	3.1	3.9	82.8	73.3	100.0	100.0		

* Figures not available

(1) Includes Entomological Inspectors

(2) Includes Headquarters and District offices, malaria survey, special investigations and employees temporarily attached to Headquarters pending assignment to States.

Monthly Report
Malaria Control in War Areas
September, 1942

Maintenance of effective larviciding in areas already in operation was the major objective of the Malaria Control in War Areas program during September. To this end, 350 additional workers were employed although the number of projects increased by only three. Larvicidal and minor drainage projects were controlling malaria mosquito production in 137 war areas including about 570 war establishments and a total of 3745 people were employed on the program at the end of the month. Table II shows the number of employees and the monthly payroll by states.

Although it had been anticipated that September might bring an increase in malaria incidence and the headquarters office was prepared to assist in controlling possible epidemics, there was no reported evidence of any marked increase in malaria during the month.

Larvicidal Program - Table I shows data on the progress of the larvicidal and minor drainage program. During the month approximately 350,000 gallons of oil and 75,000 pounds of paris green were used to control malaria mosquito production in 8,400 miles of narrow ditches and 20,000 acres of ponds and large streams. Minor drainage operations carried on in conjunction with the larvicidal program eliminated or reduced the need for larvicidal treatment of 350 miles of ditches and streams. In addition, some 825 miles of ditches and 960 acres of ponds were cleared of debris and vegetation to eliminate breeding places for *A. quadrimaculatus* or to facilitate larvicidal treatment. About 465,000 man-hours of labor were required for this work.

Control work in the vicinity of Georgetown, South Carolina was suspended during September. The project was found to be unjustified on the basis of military significance. Larvicidal work was started in three areas in Maryland and California.

Entomological data show that satisfactory control was being obtained at 95 percent of the war establishments. There are indications that in some areas the entomological data are not being utilized as fully as possible in planning control work. This is due in part to the rapid turnover of field supervisory personnel. Steps have been taken to make certain that new field supervisors understand the value of the entomological data and are able to interpret them.

During the current season entomological reports have not reached the headquarters office as promptly as is desirable. Relatively few reports reach Atlanta in less than two weeks after field observations are made and the reports from some areas have been submitted at irregular intervals. A modification of the reporting system is being considered which should promote the prompt receipt of the most essential entomological data at headquarters during the 1943 larvicidal season.

Airplane dusting with paris green of the water chestnut covered areas of the Potomac River in the vicinity of Fort Belvoir continued throughout September and was discontinued at the end of the month. During September, the bulk of the water chestnut growth broke up and disappeared. Entomological inspections indicated that the control work was quite effective and the *A. quadrimaculatus* density decreased rapidly after the middle of September. During the week ending October 3 no *A. quadrimaculatus* were taken in the three light traps near Fort Belvoir.

Power oil-water sprayers were used with considerable success in the Platte City, Missouri, area and the Miami, Oklahoma, area. Adequate control had not been possible in these areas with hand operated equipment. Special boats were constructed by the MCWA crews in these areas to carry this power equipment.

During October the need for larvicidal treatment will decrease and by the end of the month such work will have been discontinued in most areas in the more northerly states. In the states farther south the larvicidal season will extend into November and in Puerto Rico, southern Texas and perhaps a few other areas, some larviciding will continue throughout the winter.

In most war areas minor drainage operations will utilize available personnel and equipment. However, in some areas there will be relatively little of this type of work and it will be possible to close the project for the winter and transfer the much needed supervisory employees and equipment to the major drainage program.

Projects thus closed will be reopened before the 1943 mosquito breeding season starts in order to permit such minor drainage and clearing as is necessary. This work, to be effective, must be delayed until after the spring high water season.

Major Drainage - A large part of the Dam Neck drainage project near Norfolk, Virginia, was completed during September. Because of the difficult soil conditions encountered, about 5,000 more pounds of dynamite will be required than was anticipated in the original estimates but the cost will still be only a fraction of that which the other methods of construction would have entailed.

Four major drainage project proposals for winter operation were received during September. Plans have been completed for a second dynamiting project at Pine Bluff, Arkansas, to be undertaken in October. A series of pictures on the inside rear cover of this report illustrates the use of dynamite in drainage work.

Equipment - Sixteen additional cars and trucks were obtained during the month, making a total of 453 now in operation. Power sprayers were obtained for two projects. Negotiations are in progress with the Army and the W. P. A. for the transfer of trucks and certain heavy pieces of equipment which will be needed in connection with the drainage program.

September, 1942

Personnel - Fourteen engineers and entomologists reported for duty during September and the prospects of obtaining additional professional employees seem better than they did a month ago. The Fifth Civil Service Regional Office has been very helpful in recruiting personnel.

Blood Index - Collection of blood slides for the fall survey of malaria among school children in war areas was started during September. A total of 3718 slides were examined in the Memphis laboratory and 32 positives (0.86 percent) were found. Of the slides examined 1601 were from schools, 1977 from the vicinity of Stuttgart and Newport, Arkansas, where house spraying programs are in operation (see July report) and 140 were from a special survey made at Memphis, Tennessee.

The results available to date are too fragmentary to warrant any general conclusions. The relatively low incidence of malaria in the Stuttgart area may be due to a large degree to the fact that most houses and public buildings (even the baseball park) are screened to exclude the voracious pest mosquitoes (Psorophora columbiae) which breed extensively in the rice fields of the Grand Prairie region of Arkansas.

Dog Fly Control - The dog fly control project being operated jointly by the Bureau of Entomology and Plant Quarantine of the Department of Agriculture and the Public Health Service along the Western Florida Gulf Coast continued operation throughout September and was successful in preventing the usual general outbreak of flies. Military operations in the area were thus enabled to proceed in a normal manner. The unusually heavy marine grass deposits, coupled with shortages of labor, equipment and supplies have necessitated some reduction in the area covered in order to ensure adequate control in the breeding areas closest to important military installations. Four additional sprayers were placed in operation during the month making a total of 16 sprayers in operation.

During the month 427,250 gallons of creosote spray were applied to 281 miles of grass deposits along 450 miles of shore line. The mean dog fly incidence for the period August 21 to October 3 was 20.6 flies per cow based on counts from 2,506 animals at 510 different points over the entire control area. In the Pensacola-Fort Walton area, the mean was 19.6, in the Panama City area, 18.0, and in the Apalachicola-Carrabelle area, 31.1 flies per animal. The greatest density of flies occurred during the week ending September 26, when the average was 36.2 flies per animal, and the lowest population was found during the week ending September 12 when the average was 8.2 flies per animal.

Aedes aegypti Control - Work was continued throughout September at all of the previously established projects and projects were started at five small communities in the lower Rio Grande Valley in Texas.

September, 1942

A total of about 125,000 premises were inspected during September to locate *Aedes aegypti* breeding places. At Key West the breeding index* has been reduced from 38 percent before control to 7.3 percent during the latter part of September. At Charleston, South Carolina where the original breeding index was 12 percent, the index is now only 3.2 percent. On the Texas projects, the average number of premises per block on which *Aedes aegypti* breeding was found has been used as a breeding index. Reports indicate that the incidence of breeding now is generally less than 50 percent of what it was before control work began.

Outdoor breeding will continue throughout the winter in the lower Rio Grande Valley and at Key West and Miami, Florida. At the more northerly cities however the winter temperatures will usually prevent breeding except in sheltered places. The inspectors will concentrate on the location and elimination of these "holdover" places of *Aedes aegypti* production. Among the principal sources of winter breeding are the cotton warehouses where large numbers of fire barrels are always present. Experiments are being made to determine the most effective, inexpensive, and long lasting larvicide for treatment of such breeding places. The use of a larvicide such as oil, which requires weekly application, would render control of breeding in these containers an extremely costly and arduous task. A non-volatile material whose larvicidal properties will be maintained over a period of several weeks or more, would materially aid in year around control of mosquito breeding in the barrels.

Several of the cities where yellow fever and dengue control programs have been inaugurated have large numbers of cisterns used for household water supply. A majority of these continue to be used, but many have been abandoned because the need has been eliminated by the extension of municipal water systems. Cisterns which are not effectively mosquito-proofed are constant sources of heavy *Aedes aegypti* breeding.

During the winter months it is planned to seal with concrete, cracks and other small openings in the tops of cisterns which are kept in use. Abandoned cisterns may be sealed or filled with earth, whichever is cheaper, in order to eliminate permanently these sources of mosquito breeding. Above-ground wooden water tanks which are not completely mosquito tight will have openings screened wherever possible.

Educational and publicity channels have been effectively utilized in securing public cooperation for the elimination of *Aedes aegypti* breeding places, particularly in Texas. When each individual householder recognizes his responsibility for keeping his own premises free of miscellaneous containers which might collect rain water, the amount of work required from the inspectional service is much reduced. Public talks, radio programs, movie trailer showings, and newspaper

*The percentage of the premises inspected on which *Aedes aegypti* were found to be breeding.

September, 1942

articles have been utilized effectively. In some instances cooperating volunteer groups have provided considerable aid to local programs. It has been possible to operate effectively with smaller staffs through this method of organization.

Pest Mosquito Control - At the request of the Navy Department the office of Malaria Control in War Areas has made special surveys to determine the cost of controlling pest mosquitoes in the vicinity of a selected group of Navy establishments where the density of non-disease carrying mosquitoes was such as to interfere seriously with the activities of naval and essential civilian personnel. Preliminary surveys indicate that a reasonable reduction in mosquito prevalence is possible in seven of the eleven surveyed areas. In the other four areas, effective control measures would be costly and of questionable value because of tidal limitations, extensiveness of breeding marshes, infeasibility of drainage, and other complicating factors. In one area (New Orleans), the monetary value of large muskrat marshes presents a difficult barrier.

Control would be achieved largely by drainage and larvicidal treatment with some diking and pumping. In most of the areas salt marsh mosquitoes are the principal pest varieties but in two areas fresh water marsh mosquitoes are more important.

Preliminary estimates indicate that the initial cost of programs for controlling mosquito production in the heavy breeding marsh areas within a five mile radius of naval establishments in the seven areas where effective control is considered possible would be about \$1,000,000 and the annual operating cost would be about \$400,000. Periodic flights carried in by winds from breeding areas beyond the control zone might still occur.

Effective control during the 1943 breeding season would depend upon the completion of much of the major drainage work before the next mosquito breeding season. Shortages of materials, equipment, and personnel will limit the extent of control operations.

Expenditures - About \$411,740 of Public Health Service Funds were encumbered during August. The approximate amounts were as follows:

.01 Personal Services	\$345,400
.02 Travel	10,000
.04 Communication Services	1,160
.05 Rent	1,000
.07 Other Contractual Services	1,320
.08 Supplies and Materials	45,480
.09 Equipment	7,380
Total	<hr/> \$411,740

September, 1942

POLICIES GOVERNING MCWA MAJOR DRAINAGE WORK

The differences between the policies governing major drainage work of the Malaria Control in War Areas program and similar work done under other auspices has been emphasized in conferences with State Health Department officials. Under ordinary circumstances malaria mosquito control by drainage is more economical than equivalent control by larviciding since larvicidal treatment must be continuous and drainage works require only minor expenditures for maintenance and repair. The higher first cost of drainage work is usually more than offset by the lower recurring cost.

However, under the MCWA program, justification for the control work is the protection of military personnel and essential war workers who, as a rule, will reside in a malarious area only temporarily. Consequently the period of time over which drainage work can be amortized is, although indefinite and contingent on the duration of the war, much shorter than when the population to be protected is permanently established. Because of the temporary nature of the Malaria Control in War Areas program the major control work will be done by larvicidal treatment of areas where *Anopheles quadrimaculatus* are breeding. Major drainage work will be limited to those breeding areas where effective control cannot be achieved by larviciding and those areas where the cost of effective larviciding is so great that drainage is obviously more economical.

Permanent ditch linings of concrete, brick, or masonry will be used only where:

1. The grade is so flat that a smoothly lined ditch is necessary for proper drainage.
2. The grade is so steep that lining is necessary to prevent erosion or scour.
3. The ditch is part of the system of a permanent community, and the community contributes the necessary material for the lining.

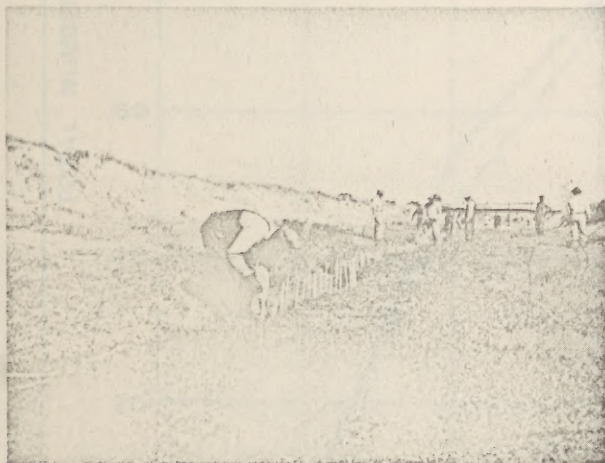
The man-power situation in each locality must be considered in connection with major drainage work. The resources of the W. P. A. will be used wherever possible and competition for essential industrial and agricultural labor will be avoided. On the other hand, any drainage work done this winter will reduce the number of workers and the amount of larvicide equipment and transportation needed during the 1943 larvicidal season. For this reason as much drainage work as is clearly justified should be done during the coming winter.

MALARIA CONTROL DRAINAGE BY DYNAMITING

Before it was drained, this area, less than a mile from an important arsenal, was a swamp covered with from two to twenty inches of water. It was a source of prolific malaria mosquito breeding and a hazard to the health of the essential war workers.



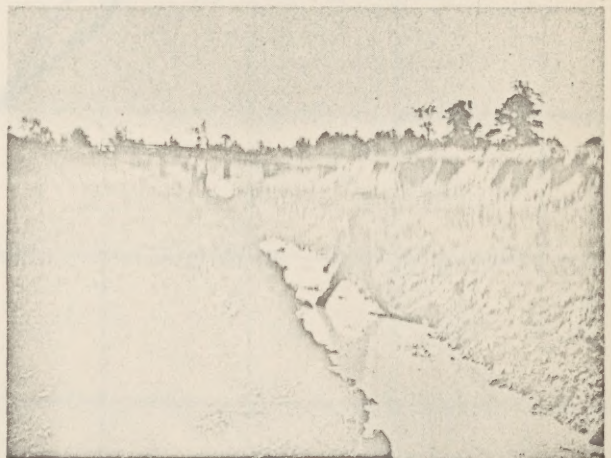
Weekly larviciding of the swamp was difficult, time-consuming, expensive, and only partially effective. By draining the swamp into a nearby stream, the need for larvicidal treatment was eliminated.



The workers in this picture are placing the dynamite. Each stick in the picture marks a hole containing several sticks of dynamite. An explosives expert determines from the soil conditions and the size of ditch desired, the proper explosive to use and the correct size spacing, and depth of charges and the proper method of detonating the explosive.



The explosion has thrown the earth several hundred feet in the air. On this job the propagation method of firing was used. The dynamite in an end hole is primed with an electric blasting cap and this cap detonated by an electric blasting machine. The shock of the explosion of the primed stick detonates the dynamite in the adjacent hole and this continues throughout the section of ditch to be blasted. As much as one-half mile of ditch may be shot at one time.



Water from the swamp is beginning to flow into the ditch. A dynamited ditch is usually two to three times as wide as it is deep and has well sloped side walls. Note how the spoil is deposited evenly for some distance back from each bank of the ditch.

This job was completed quickly and cheaply without the use of machinery indispensable on other war work and with little labor. Blasting is a particularly effective method of ditch construction in wet compact soils. In dry loose soils, other ditching methods may be more economical.

U.S. PUBLIC HEALTH SERVICE
MALARIA CONTROL IN WAR AREAS

NUMBER MALARIA MOSQUITO CONTROL PROJECTS
IN OPERATION AND NUMBER OF EMPLOYEES

